

SYPHILIS

Risk of syphilis in STI clinic patients: a cross-sectional study of 11 500 cases in Guangxi, China

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Objective: To measure prevalence of syphilis among the STI clinic population in Guangxi, China, and to assess the socioeconomic and behavioural characteristics associated with the infection.

Methods: We undertook a cross-sectional survey and syphilis and HIV serologic testing among 11 473 patients attending 14 community and hospital-based dermatovenereal clinics across eight cities in Guangxi between December 2004 and February 2006.

Results: 1297 (11.9%) patients demonstrated positive toluidine red unheated serum test and *Treponema pallidum* particle agglutination results with serologic testing. A total of 58% (752) of seropositive subjects presented with a genital ulcer, palmar/plantar rash or inguinal lymphadenopathy. Female sex (OR=2.23, 95% confidence intervals (CI)=1.69 to 3.00, $p<0.001$), less education (middle school, OR=1.70, 95% CI=1.11 to 2.62, $p=0.023$; primary school or less, OR=1.98, 95% CI=1.13 to 3.46, $p=0.017$) and high annual income (OR=1.91, 95% CI=1.18 to 3.10, $p=0.009$ for >30 000 RMB yuan) were associated with serologically positive status. Syphilis infection was significantly more prevalent in city 2 (19.5%, OR=3.07, 95% CI=1.83 to 5.16, $p<0.001$), city 4 (16.6%, OR=1.90, 95% CI=1.10 to 3.28, $p=0.011$) and city 8 (13.8%, OR=1.83, 95% CI=1.13 to 2.97, $p=0.006$). A total of 40.1% (532) of infected subjects engaged in commercial sex and increased rates of the infection was associated with multiple sexual partners (OR=1.54, 95% CI=1.16 to 2.06, $p=0.003$). A total of 1.2% (133) of participants carried laboratory markers for HIV and 1.8% (23) of patients with syphilis were positive for HIV.

Conclusions: Syphilis infection has reached alarming rates in China's STI clinic population, suggesting a generalised spread of the disease through commercial sex and bridging populations. Syphilis control is deserving of China's highest priority. Universal screening for syphilis and HIV testing in STI clinics should be considered as measures for control.

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China is suffering a growing syphilis epidemic.^{1, 2} According to national sentinel site data, incidence increased from 1.4 cases/100 000 people in 1993 to 32.9 cases/100 000 people in 1999.² Nationwide surveillance data (obtained through mandatory case reporting) indicated that China's average incidence of active syphilis in 2004 was 8.7 cases/100 000 people and that the rate in Guangxi Autonomous Region (the focus of our study) was more than 20 cases/100 000 people.³ Congenital syphilis has also increased dramatically, consistent with a generalised epidemic.²

The rise in syphilis infection rates is concurrent with increases in other sexually transmitted infections (STI), including human immunodeficiency virus (HIV) infection.^{4, 5} Sexual transmission is a major route of HIV infection in China, responsible for 43.6% of HIV cases.⁶ Furthermore, STI, particularly genital ulcer disease (GUD) as with herpes and syphilis, are strongly associated with HIV acquisition.^{7–10}

Accordingly, recognition and treatment of syphilis represent important public health measures and are crucial to HIV and congenital syphilis control and prevention. The current study was undertaken to evaluate subjects with syphilis detected at STI clinic sites

METHODS

Study sites

The study was conducted in eight cities across Guangxi province located in southern China. We selected cities to encompass an array of socioeconomic and geographic regions within Guangxi. City 1 and city 2 are coastal cities with slow-paced economies. City

3 and city 4 are neighbouring cities, have strong manufacturing industries and are undergoing rapid economic development. City 5 and city 6 are centrally located and include the provincial capital. Lastly, city 7 and city 8 are more remote and border Guangdong province (table 1). All cities are connected by major highway routes and transportation and communication between sites are relatively easy.

Study sites were dermatovenereal clinics (STI clinic). Cities 1, 2, 3, 4, 5 and 7 included a community STI clinic and an STI clinic within a general hospital. A general hospital was the only site in City 6 and City 8. Study protocols were reviewed and approved by each site's STI clinic directors and relevant staff received training on the study protocol.

Participants

Between December 2004 and February 2006, potential participants were identified at the STI clinics. Patients who required only outpatient examination and treatment were consecutively recruited to participate. Although increased risk for STI has been documented among adolescents in other countries, sexual debut tends to occur in young people above the age of 18 years in China,^{11, 12} therefore we limited participation in this study to patients 18 years and older so as to encompass patients representative of those at risk for STI. Site staff secured verbal consent from subjects to have blood drawn for free syphilis and

Abbreviations: CSWs, commercial sex workers; GUD, genital ulcer disease; MSM, men who have sex with men; STI, sexually transmitted infection; TPPA, *Treponema pallidum* particle agglutination; TRUST, toluidine red unheated serum test

Table 1 Characteristics of study areas

City	Location	Population*	GDP per capita†	Special Remarks
1	South	1 499 800	NA	Borders Beibu Gulf
2	South	3 127 700	4636	Special economic development zone, large city harbour
3	North	528 300	9337	Prefecture-level city
4	North	3 668 000	9337	Automotive industrial hub
5	Central	4 152 100	2882	Largest river port in Guangxi
6	Central	6 457 100	7874	Largest and most economically developed city in Guangxi, multiple HIV and STI programs and services
7	East	934 900	NA	County-level city
8	East	5 497 500	4160	Main transportation thoroughway connecting Guangxi and Guangdong provinces

*Data from the 2005 Guangxi Census, National Bureau of Statistics of China.

†Data from the Guangxi Autonomous Region Statistics Network.

NA, not available.

HIV testing and to respond to an anonymous survey administered by the examining physician and/or health care worker.

The study protocol was approved by the Protection of the Rights of Human Subjects Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill and the Medical Ethics Committee at the National Center for STD Control (NCSTD) and the Chinese Academy of Medical Sciences (CAMS) Institute of Dermatology at Nanjing.

Study measures

We considered a range of socioeconomic and behavioural factors in our survey. Socioeconomic characteristics investigated comprised sex, age, relationship status, ethnicity, employment, education and residence. Behavioural information gathered were number of sexual partners, condom use, having received money for sex (also referred to as commercial sex work), having offered money for sex (also referred to as commercial sex use), any drug use (type and method not questioned), having a sexual partner who uses any drugs, being a man who has sex with men (MSM) and monthly participation in social activities (also referred to as social outings). Medical histories were reviewed for patients presenting symptoms. Findings from targeted physical examinations, including detailed skin, lymph node and genital examination, were also recorded.

Blood was drawn from each patient for syphilis serologic testing and patients were given their diagnosis and counselling for treatment immediately upon receipt of results. Specimens were stored on site until they could be taken (on a bimonthly basis) to the National STD Reference Laboratory at NCSTD for syphilis and HIV serologic testing. At the Reference Laboratory, the toluidine red unheated serum test (TRUST; Rongsheng Biotech Inc, Shanghai, China) was used for screening, and the *Treponema pallidum* particle agglutination test (TPPA; Serodia TPPA; Fujirebio Inc., Tokyo, Japan) was used for confirmation of those with positive TRUST results. Cases with positive TRUST North Carolina at Chapel Hill were defined as serologically positive for syphilis. Results from testing conducted at the Reference Laboratory were used in this study analysis.

Statistical analysis

Survey and serologic test results were concurrently double-entered into a computer database by independent research assistants. Databases were evaluated for congruency using Epi Info Software (V. 6.04; CDC, Atlanta, Georgia, USA). When database entries conflicted, the original test results and surveys for these cases were retrieved to correct entered data.

All statistical analysis was performed using SPSS CV.13.0; SPSS Inc., Chicago Illinois, USA. χ^2 tests were employed for univariate analysis of sociodemographic and behavioural variables. For multivariate analysis, we used logistic regression in a stepwise backward sequence and selection of variables for

entry into the logistic model was based on odds ratios where $p < 0.1$ in univariate analysis. Factors with $p < 0.05$ in multivariate analysis were considered statistically significant.

RESULTS

General description of participants

A total of 11 473 patients were enrolled in the study, and 531 cases were later excluded from analysis due to missing survey responses; 12 cases were excluded for missing or duplicate samples. The 10 930 remaining cases from the 8 community clinics (9341; 85.5%) and 6 general hospitals (1589; 14.5%) were used in the analysis. Demographic description of study participants can be found in table 2. Also summarised in table 2 are the observed percent syphilis infected for each subgroup with the noted demographic characteristic and the 95% confidence interval (CI) within which the true proportion of infected falls.

Study subjects ranged from ages 18 to 91 years with mean age of 32.6 years and median age of 30 years. Participants were 59.4% (6488) male and 40.6% (4437) female. Ethnic groups included Han (75.8%; 8284), Zhuang (20.4%; 2225) and other unspecified groups (0.6%; 71). Almost three quarters (72.9%; 7969) of the participants were married or cohabited with their steady sexual partner. Employment was largely in agriculture or labour (35.2%; 3847), followed by self- or unemployment (30.6%; 3344) and entertainment or service (13.7%; 1499). The majority was composed of persons with education equal to or less than middle school (52.6%; 5748) and who earned an annual income of less than 10 000 RMB yuan or 1282 US dollars (47.6%; 5203). The numbers of participants from each city are detailed in table 2. A total of 99.4% (10 868) of participants resided locally to their testing site.

Syphilis infection and associated factors

A total of 1297 (11.9%) patients were seropositive for syphilis, 1045 (80.5%) of which were identified at community STI clinics and 252 (19.5%) of which were diagnosed at general hospitals. A total of 58.0% (752) of seropositive subjects presented with a genital ulcer, palmar/plantar rash or inguinal lymphadenopathy. Co-infection with HIV was found in 23 subjects. HIV was more common among patients with syphilis than without (1.8% versus 1.1%, OR = 1.57, 95% CI = 1.00 to 2.47, $p = 0.05$). Among the 531 cases excluded due to missing survey responses, 13.6% (72) were seropositive for syphilis, suggesting against selection bias. Results of the multivariate analysis are summarised in table 3.

Gender strongly influenced disease rates. Higher syphilis prevalence was documented in female patients than in male patients (14.3% versus 10.2%, OR = 2.23, 95% CI = 1.69 to 3.00, $p < 0.001$). When examining risk-taking behaviours attributable to each sex, we discovered that 33.8% (2174) of men versus 20.5% (906) of women acknowledged having multiple partners.

Table 2 Demographic and sociobehavioural characteristics of study population

Factor	No. CC attendees (%)	No. GH attendees (%)	% Seropositive for syphilis (95% CI)
Age group (years):			
18–25	2661 (28.7)	434 (27.3)	11.4 (10.4 to 12.6)
26–35	3649 (39.4)	690 (43.4)	11.9 (11.0 to 12.9)
>35	2955 (31.9)	465 (29.3)	12.2 (11.1 to 13.3)
Sex:			
Male	5317 (57.4)	1109 (69.8)	10.2 (9.4 to 10.9)
Female	3944 (42.6)	479 (30.2)	14.3 (13.4 to 15.4)
Ethnicity:			
Han	6845 (76.3)	1367 (88.9)	11.4 (10.7 to 12.1)
Zhuang	2064 (23.0)	159 (10.3)	13.3 (12.0 to 14.8)
Relationship status :			
Single (unmarried, divorced, widowed)	2229 (24.6)	394 (26.9)	10.2 (9.1 to 11.5)
Married (first, remarried)	6196 (68.3)	1045 (71.4)	12.3 (11.6 to 13.1)
Cohabiting	651 (7.2)	24 (1.6)	11.2 (9.1 to 13.8)
Employment:			
Science & technology or civil service	844 (9.7)	96 (6.4)	6.2 (4.8 to 7.9)
Student	93 (1.1)	8 (0.5)	7.9 (4.1 to 14.9)
Agriculture or labour	2722 (31.7)	1030 (68.7)	11.7 (10.7 to 12.8)
Entertainment or service	1383 (15.8)	113 (7.5)	11.5 (10.0 to 13.3)
Self- or unemployed	3131 (35.8)	198 (13.2)	13.6 (12.5 to 14.8)
Other	514 (5.9)	55 (3.7)	10.7 (8.4 to 13.5)
Education:			
College or higher	1005 (11.0)	174 (11.2)	8.3 (6.9 to 10.0)
High school	3279 (36.0)	321 (20.7)	10.9 (10.0 to 12.0)
Middle school	3975 (43.7)	802 (51.7)	12.7 (11.8 to 13.7)
Primary school equivalent or less	762 (8.4)	153 (9.9)	13.5 (11.5 to 15.9)
Annual income (RMB):			
<10 000	3991 (51.2)	1158 (78.3)	11.7 (10.9 to 12.6)
10 001–30 000	3362 (43.1)	228 (15.4)	10.5 (9.6 to 11.6)
>30 000	449 (5.8)	92 (6.2)	16.4 (13.5 to 19.8)
Residence:			
City 1	1222 (13.2)	83 (5.2)	6.2 (5.0 to 7.7)
City 2	684 (7.4)	465 (29.3)	19.5 (17.3 to 21.9)
City 3	1000 (10.8)	36 (2.3)	10.8 (9.1 to 12.9)
City 4	1418 (15.3)	95 (6.0)	14.2 (12.5 to 16.1)
City 5	773 (8.3)	816 (51.4)	8.4 (7.2 to 9.9)
City 6	1841 (19.9)	0	11.0 (9.7 to 12.5)
City 7	0	94 (5.9)	3.5 (1.7 to 7.5)
City 8	2327 (25.1)	0	13.8 (12.5 to 15.3)
No. of partners:			
1	3902 (42.4)	887 (56.2)	10.8 (10.0 to 11.8)
>1	2853 (31.0)	204 (12.9)	13.6 (12.4 to 14.9)
Condom use:			
Yes	750 (9.5)	180 (11.7)	9.6 (7.9 to 11.7)
No	4085 (51.6)	697 (45.2)	13.6 (12.6 to 14.6)
Commercial sex work:			
No	5602 (63.9)	773 (49.0)	11.3 (10.6 to 12.1)
Yes	939 (10.7)	167 (10.6)	14.2 (12.2 to 16.3)
Commercial sex use:			
No	2198 (29.8)	619 (39.6)	12.1 (10.9 to 13.3)
Yes	3168 (42.9)	299 (19.1)	12.2 (11.1 to 13.3)
Self or partner drug use:			
No	9039 (99.1)	1508 (95.7)	11.8 (11.0 to 12.6)
Yes	80 (0.9)	68 (4.3)	19.5 (13.9 to 26.6)
Men who have sex with men:			
No	5068 (77.2)	933 (62.8)	11.2 (10.4 to 12.0)
Yes	5 (0.1)	19 (1.3)	24.0 (11.6 to 43.6)
Social outings (outings/month):			
<5	4272 (52.2)	1053 (67.5)	11.3 (10.5 to 12.2)
≥5	533 (6.5)	179 (11.5)	12.6 (10.4 to 15.2)

*Data on participants who refused to provide responses are not included in the table.

†1 RMB is approximately 0.13 US\$.

CC, community STI Clinic; GH, STI clinic within a general hospital; CI, confidence interval.

Also, commercial sex use was noted in 52.4% of men while 17.1% of women were identified as commercial sex workers (CSWs). When CSWs were excluded, infection rates remained higher in women than in men (14.3% versus 9.9%, OR = 1.51, 95% CI = 1.33 to 1.71, $p < 0.001$) in univariate analysis.

Multivariate analysis demonstrated significantly more infection with limited education (equivalent or less than middle school, OR = 1.63, 95% CI = 1.31 to 2.04, $p < 0.001$), but also with higher annual income (>30 000 RMB yuan or 3850 US

dollars, OR = 1.91, 95% CI = 1.18 to 3.10, $p = 0.009$). Persons with higher annual income and with either limited education (12.3%, OR = 2.09, 95% CI = 1.25 to 3.50, $p = 0.01$) or higher education (education equal to or greater than college, 16.3%, OR = 2.91, 95% CI = 1.41 to 6.00, $p = 0.004$) were at least twofold more likely to be infected with syphilis than those with lower income and higher education (6.3%).

Although higher rates of infection were observed in groups with any risk-taking behaviours, only having multiple partners

Table 3 Multivariate analysis of factors associated with syphilis infection

Factor	OR (95% CI)*	p Value
Sex:		
Male	Reference	
Female	2.23 (1.69 to 3.00)	<0.001
Education:		
College or higher	Reference	
High school	1.27 (0.82 to 1.96)	0.283
Middle school	1.70 (1.08 to 2.62)	0.023
Primary school equivalent or less	1.98 (1.13 to 3.46)	0.017
Annual income (RMB)*:		
<10 000	Reference	
10 001–30 000	1.04 (0.80 to 1.36)	0.750
>30 000	1.91 (1.18 to 3.10)	0.009
Residence:		
City 1	Reference	
City 2	3.07 (1.83 to 5.16)	<0.001
City 3	1.29 (0.52 to 3.22)	0.357
City 4	1.90 (1.10 to 3.28)	0.011
City 5	0.91 (0.53 to 1.58)	0.749
City 6	1.43 (0.85 to 1.41)	0.103
City 7	0.45 (0.15 to 1.34)	0.193
City 8	1.83 (1.13 to 2.97)	0.006
No. of partners:		
1	Reference	
>1	1.54 (1.16 to 2.06)	0.003

*1 RMB is approximately 0.13 US\$.
OR, odds ratio; CI, confidence interval.

(OR = 1.54, 95% CI = 1.16 to 2.06, $p = 0.003$) was concluded to be independently associated with infection. Among seropositive patients with multiple partners, two thirds (275) were married or cohabiting with a regular sexual partner and more than three quarters of the group (357) were engaged (purchasing or selling) in commercial sex.

Syphilis infection was significantly associated with city 4 (OR = 1.90, 95% CI = 1.10 to 3.28, $p = 0.01$), city 6 (OR = 3.06, 95% CI = 1.83 to 5.16, $p < 0.001$), and city 8 (OR = 1.83, 95% CI = 1.13 to 2.97, $p = 0.006$) in multivariate analysis. Interestingly, certain risk-taking behaviours were more prominent in each of the aforementioned cities; most CSWs in this study were found in city 3 (26.1%, 289) and city 4 (30.2%, 335); most commercial sex clients originated from city 8 (26.9%, 943), and most drug users and persons with drug-using partners were identified in city 3 (22.8%, 34) and city 2 (32.9%, 49).

DISCUSSION

Syphilis is a serious infection with potential to cause severe and life threatening disease.¹³ We have recently reported on its magnitude in China based on national surveillance data and on its uniform rise across low- and high-risk populations^{1 2} In the current study, we provide further details on the epidemic, reporting the prevalence of syphilis in STI clinic patients representing different segments of the population in Guangxi.

Syphilis was detected in 11.9% of the STI clinic population. This prevalence greatly exceeds most other reports in China,^{14–18} as well as those among STI clinic attendees in developed countries,^{19 20} India,²¹ and parts of Africa.^{22 23}

Syphilis prevalence was not distributed equally across the Guangxi region population. The high prevalence of syphilis in neighbouring cities 3 (10.8%) and 4 (14.2%) reflects the availability of commercial sex and drugs in these cities and the co-impact of these two aspects in driving parallel STI and HIV epidemics in Guangxi. In China, 5–15% of female sex workers use illicit drugs²⁴ and a study in Guangxi found that 97% of its drug-using sex workers traded sex for drugs.²⁵ Drug

use among sex workers is associated with not only HIV infection, but also other STI.^{24 26}

Conversely, multiple partners, failure to use condoms, and exchanging sex for drugs have been widely documented in Chinese drug users²⁴ and cause concern that drug-using communities might act as bridging populations in the sexual transmission of HIV and other STI into the general population²⁷ as has been observed in neighbouring Thailand and Russia.^{28–30} The role of drugs and commercial sex in the spread of syphilis might be more profound in Guangxi, already burdened with large and overlapping HIV, STI, drug using, and commercial sex communities.^{5 25 31 32}

Results of the analysis of behavioural characteristics reiterate commercial sex as a dominant proponent in the spread of syphilis in Guangxi. Exposure to commercial sex was noted in 41% of seropositive patients, which we suspect to be a gross underestimation due to under-reporting, perhaps explaining why commercial sex did not emerge as a risk factor for syphilis in our multivariate analysis. Prevalence of syphilis among sex workers found in recent studies in China range from 9.5%–15.7%^{26 33 34} and a small study of 393 entertainment workers in Liuzhou, Guangxi showed a syphilis prevalence of 17.56%.³⁵ Commercial sex clients in China remain difficult to study. Using compiled data for a review study, Lin *et al* calculated a median syphilis prevalence of 3.04% in this group¹ which, given our study results, appears to be a conservative estimate.

The high rate of syphilis among our married participants likely reveals the subsequent transmission of syphilis from commercial sex clients to their wives. Our finding that higher income was associated with syphilis infection suggests that women with a partner who possesses the financial resources to devote to commercial sex are particularly vulnerable to infection. This is entirely consistent with a national study in China on the spread of chlamydia in the general population that found having a steady male partner who earned a high income to be a risk factor for chlamydia in women.³⁶ The risk of high income men and their female partners for STI might only climb with economic growth as it has been shown that the highest incidences of STI are in China's wealthiest areas.³⁷

Key messages

- The prevalence of syphilis in China's STI population is extraordinarily high and exceeds those reported in similar studies conducted in developed nations, India and parts of Africa.
- Active commercial sex industries and high-risk behaviours, such as multiple partners, lack of condom use and drug use, sustain infection in the STI population and bridge infection into the general population.
- Syphilis is known to increase risk for acquisition and transmission of HIV, and the high rates of syphilis infection and co-infection with HIV seen in the STI population portend escalation of China's HIV epidemic.
- Universal testing for syphilis and HIV in China's STI population should be considered as reasonable measures for syphilis and HIV control.

Within a mere generation (25 years), China has achieved rapid economic growth that has outstripped the rate of educational attainment, and health care workers must catch up in its public health initiatives so that people might be as informed in their sexual decision making.

We found that 1.8% of the subjects with syphilis were also infected with HIV. Genital ulcer disease, including syphilis, is known to be a risk factor for the acquisition and transmission of HIV.⁸⁻¹⁰ In another report from this population, our research group presented data showing that the HIV prevalence to be more than 24-fold greater in this STI clinic population than in the general population, and that syphilis represented a significant risk factor for HIV infection.³⁸

STI and HIV could be greatly prevented by proper condom usage.³⁹ Therefore, it was not surprising that the majority of patients who presented at the STI clinics admitted poor condom use. Failure to use condoms was also recorded in 63.3% (2669) of persons engaged in commercial sex and 38.8% (1871) of subjects with multiple partners. In city 4, 100% condom use programs are known to be in place, but condom use was only reported to be 22.9% by patients from that city. Condom promotion is failing throughout Guangxi. Public education should simultaneously emphasise condoms as barriers against pregnancy, STI and HIV.

Our study has obvious limitations. First, the sample might not be entirely representative of the patient population attending these STI clinics. Similarly, our study population might not be representative of all STI clinic populations in Guangxi or other provinces. Third, our data on high-risk behaviours are incomplete. Fourth, the brevity of the interview in the clinic cannot provide a complete view; while the sociodemographic and behavioural factors identified in our study are informative a stronger grasp of China's current syphilis epidemic and how it differs in complexity to China's earlier epidemic half a century ago⁴⁰ are crucial to successful intervention.

These results have several important public policy implications. First, our study supports universal screening for syphilis in high-risk populations, such as STI clinic attendees, as a decisive measure to control syphilis. China's current clinical guidelines (excluding those in regards to antenatal testing and partner notification) instruct health care providers to offer serologic testing to persons presenting with hallmark signs/symptoms of syphilis (genital ulcer, inguinal lymphadenopathy, palmar/plantar rash, or cardiovascular, orthopaedic or

neurological findings).⁴¹ 40% (519) of study subjects bearing serologic markers for syphilis did not present with clinical signs/symptoms to warrant the pursuit of testing, and might have otherwise been missed if they had not participated in this study. Using symptomatic criteria to settle diagnostic testing is inefficient in the STI clinic population where syphilis prevalence is high and missing diagnosis unacceptable. Testing methods for syphilis are relatively simple and cost effective,⁴² and expanding screening services to high-risk populations could prove beneficial to thwarting not only future syphilis infection, but also HIV infection and congenital syphilis in China.

Second, HIV testing should be aggressively pursued at STI clinics and, in particular, with syphilis patients of whom a significant portion are co-infected. STI clinic surveillance serve an invaluable role in monitoring HIV seroprevalence,⁴³ and more importantly new HIV infection.⁴⁴ The increased risk for transmitting HIV during primary infection⁴⁵ and in co-infection with genital ulcer disease⁴⁶ as well as the increased susceptibility to HIV infection with genital ulcer disease^{8, 47} overwhelmingly mandate rigorous HIV screening in this population. Missed opportunities to identify HIV also have stronger implications in China, where the HIV-infected population is largely undiagnosed, hindering control of the epidemic.⁴⁸

Third, the correlated high rates of STI and commercial sex signal China's urgent need to scale up prevention programs targeting CSW. Sex trade is illegal in China, and consequently activities are not conducted at well demarcated brothels, but rather under the guise of entertainment venues, salons and massage parlours, making outreach to CSW decentralised and difficult. However, pilot studies across China implementing condom promotion, sexual health education, and the establishment of clinics for HIV testing and treatment have proved the efficacy of community-based prevention programs leading to appreciable reduction in high-risk behaviours and STI among CSW.⁴⁹ Expansion of such programs into STI and CSW burdened regions such as Guangxi are crucial to local and national disease control.

Finally, these results must be put into a broader context. At the time of the formation of the People's Republic of China, syphilis was among the most common diseases – but a massive control program comprising mass screening, elimination of prostitution and the re-education of prostitutes virtually eliminated syphilis for more than two decades.⁴⁰ The campaign was formidable in its resoluteness and mobilisation of resources, but also controversial for its Draconian measures. The current epidemic is, at least in part, fuelled by behavioural, social and economic factors emphasised in this and other reports.^{50, 51} Addressing the current epidemic will require a novel eradication campaign congruous with China's emerging social values and changing political environment. Health care reforms and political will are needed to encourage health-seeking behaviour, empower safe sexual decision making and ensure proper medical care.

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MSC, XSC and YPY conceived, designed and coordinated the study; YPY, XG, WHW, MQS, HW, QC and PYH provided on-site training and coordinated data collection; SPYW, XG, MSL, and JDT organised data for analysis; SPYW, XSC and MSC analysed the data, interpreted the results and wrote the manuscript.

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